

RESPONSE TO OFFICE ACTION MAILED 11/08/2005
"Method for Repairing Defects in Metallic Substrate Using Welding"
Serial No. 10/772,701
Examiner: Kevin P. Kerns
Atty. Docket No. 020627.035
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REMARKS

A. Specification

Applicant currently amends the abstract and paragraph [0054] of the published
5 application to incorporate the corrections noted in paragraphs 1 and 2 of the Office Action.

B. Claim Rejections Under 35 U.S.C. § 112

The Office Action rejects claims 1-21 under 35 U.S.C. § 112 as being indefinite for
failing to point out and distinctly claim the subject matter that Applicant regards as the invention.
10 Applicant respectfully traverses all rejections.

Applicant currently amends claims 1, 15, and 21 to remove the "in the vicinity" language.

C. Rejection of Claims 1, 3, 6-15, 17, 18, and 20 Under 35 U.S.C. § 103

The Office Action rejects claims 1, 3, 6-15, 17, 18, and 20 under 35 U.S.C. § 103(a) as
15 being unpatentable over either Gould et al. (US 6,545,244) or Meadowcroft (US 1,568,080) in
view of Heckethorn (US 3,081,587). Applicant respectfully traverses all rejections.

I. The Office Action Fails to Establish a Prima Facie Case of Obviousness

a) There is No Basis in the Art for the Combination of Gould or Meadowcroft with Heckethorn

20 There must be a basis in the art for the combination or modification of the prior art.

Here, the present invention directed to a resistance welding method in which the transfer of
electrical current through a substrate, having a defect, heats the substrate and a consumable filler

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slug resulting in the coalescence of the consumable filler slug and a portion of the substrate in a substantially liquid weld pool.

Conversely, Gould and Meadowcroft are directed to conductive forms of welding. In other words, they are directed to welding methods in which elements separate from the parts to be
5 joined are heated to a temperature above the melting point of the workpieces such that the heat is transferred to the workpieces by conduction resulting the formation of a weld nugget and joining of the workpieces. Further, the separate elements, or cover sheets, of Gould and Meadowcroft that supply the heat for conduction into the workpieces, do not coalesce into the weld pool. In fact, coalescence of the cover sheets of Gould and Meadowcroft would most likely render the
10 operation inoperable because the coversheets must have a significantly greater electrical resistance than the workpieces, which generally means that the material properties of the cover sheets are not beneficial, and are often detrimental, to the formation of a quality weld in workpieces having relatively high electrical conductivity.

Alternatively, Heckethorn is directed to an entirely different type of welding, expressed well
15 in Gould at Col. 5, line 1; "... it is important to realize that this process is significantly different from standard resistance welding. With the conductive heat resistance seam welding process of the present invention, formation of the joint is similar to a continuous casting." In Heckethorn, the passage of electrical current through the plug results in resistive heating of the plug and the resulting closure of the cylinder. The conductive methods of Gould and Meadowcroft were
20 developed in large part because traditional resistance welding simply does not work with many thin plate electrically conductive materials.

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Therefore, there is no basis in the art for the combination of Gould or Meadowcroft in view of Heckethorn, and thus the Office Action, has failed to establish a prima facie case of obviousness.

b) Gould or Meadowcroft are Not Properly Combinable with Heckethorn as Their

5 Intended Function is Destroyed

The combination or modification of the prior art is improper if the intended function is destroyed.

In order to achieve the resistance welding of Heckethorn, the plug must have an electrical resistance high enough to facilitate adequate generation of heat to support the melting and
10 joining of the plug and the cylinder. Now, incorporate such an electrically resistive plug in a defect in the workpieces of Gould or Meadowcroft and then cover the plug and workpieces with the conduction cover sheets. Ignoring for a moment that it does not make any sense to attempt to repair a defect in an electrically conductive workpiece of Gould or Meadowcroft with an electrically resistive plug that works with traditional resistance welding (primarily due to
15 material property issues), the heat from the cover sheets will follow the path of least resistance. This, combined with the fact that the cover sheets must have a higher melting temperature than the workpieces, but are unlikely to have a melting temperature higher than a traditional resistance welding plug, indicates that the intended functions of the methods of Gould and Meadowcroft would be not be effective in repairing a defect in the workpieces of Gould or
20 Meadowcroft with the filler plug of Heckethorn. Applying the conductive welding principles of Gould or Meadowcroft to the application of Heckethorn would destroy the function of the

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Heckethorn method as the conductive heat welding methods of Gould and Meadowcroft are highly unlikely to work with set-up of Heckethorn.

Therefore, since the references are not properly combinable or modifiable because their intended function is destroyed, the combination of Gould or Meadowcroft in view of Heckethorn, and thus the Office Action, has failed to establish a prima facie case of obviousness.

c) The Combination of Gould or Meadowcroft with Heckethorn does Not Have a Reasonable Expectation of Success

The combination or modification of the prior art is improper if there is not a reasonable expectation of success. The conductive heat welding methods of Gould or Meadowcroft do not provide a reasonable expectation of success when combined with the resistance welding filler plug of Heckethorn. In fact, one skilled in the art would believe that using a resistance welding filler plug to repair a defect in electrically conductive materials, such as those disclosed in Gould and Meadowcroft, by using conductive heat welding techniques, does not have a reasonable expectation of success, but more likely a reasonable expectation of failure.

Therefore, since the combination of references does not have a reasonable expectation of success, the combination of Gould or Meadowcroft in view of Heckethorn, and thus the Office Action, has failed to establish a prima facie case of obviousness.

d) The Combination of Gould or Meadowcroft with Heckethorn Cannot be Used to Establish Obviousness Because They are Non-analogous

The combination of the prior art is improper if the prior art is non-analogous. Specifically, a reference must be in the same field as the invention, or the reference must be reasonably pertinent to a particular problem addressed by the invention. Gould and Meadowcroft are

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directed to conductive heat welding methods, which is not the same field as modified resistance welding repair methodology of the present invention. Further, Gould, Meadowcroft, and Heckethorn are not reasonably pertinent to the problem addressed by the present invention, namely the repair of defects.

5 Therefore, since the references are not analogous to the present invention, the combination of Gould or Meadowcroft in view of Heckethorn cannot be used to establish obviousness, and thus the Office Action has failed to establish a prima facie case of obviousness.

e) The Office Action Does Not Consider All Claim Limitations in Determining Obviousness

10 The Office Action must consider all claim limitations in establishing an obviousness rejection. Here, the Office Action appears to ignore the limitation of the independent claims that the entire consumable filler slug ends up in the weld pool. This is not true of any of the cited prior art.

Therefore, since the Office Action does not consider all the claim limitations, the
15 combination of Gould or Meadowcroft in view of Heckethorn cannot be used to establish obviousness, and thus the Office Action has failed to establish a prima facie case of obviousness.

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II. Heckethorn Does Not Disclose a Method for Repairing a Defect

The Office Action mischaracterizes Heckethorn as "disclosing a method for repairing defects." In fact, the opening (32) of Heckethorn is a very purposefully placed penetration into a shock absorber.

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III. The Office Action Fails to Identify the Teaching, or Suggestion, of Numerous Limitations

a) Gould, Meadowcroft, and Heckethorn Do Not Teach, or Suggest, a Totally Consumable Filler Slug

10 Heckethorn is the only piece of cited prior art that discloses a filler slug at all. The Heckethorn filler slug is specially designed with a neck having an undulating surface so that certain portions along the perimeter of the opening allow gas flow into the cylinder, while other portions contact the perimeter of the opening. The Heckethorn filler plug is not consumed in a weld pool, or it would simply drop into the cylinder, as the electrode applies pressure, and
15 current, from only one side. Thus, the rejection of claim 1, and all of the associated dependent claims, is improper. Further, Heckethorn does not teach the welding of a plug leaving a *smooth periphery* at the point of closure, as suggested by the Office Action in paragraph 7. Rather, Heckethorn produces a "smoothly rounded outer periphery" at the point of closure (see Col. 3, lines 53-55).

20 **b) Gould, Meadowcroft, and Heckethorn Do Not Teach, or Suggest, a Defect Repair Technique Where Less Than Approximately 5% of the Heat Input Remains in the Repaired Substrate Upon Removal of the Electrodes**

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Neither Gould, Meadowcroft, nor Heckethorn teach, or suggest, a low residual heat defect repair technique. Thus, the rejection of claims 8 and 20 is improper.

c) Gould, Meadowcroft, and Heckethorn Do Not Teach, or Suggest, a Defect Repair Technique Wherein the Amount of Cooling Applied to a Weld Pool is Varied to Achieve a Desired Predetermined Property or Grain Size

Neither Gould, Meadowcroft, nor Heckethorn teach, or suggest, a cooling a weld pool, let alone varying the cooling as the pool solidifies to achieve a desirable property, such as grain size. Thus, the rejection of claims 9 and 10 is improper.

d) Gould, Meadowcroft, and Heckethorn Do Not Teach, or Suggest, the Use of Multiple Consumable Filler Slug Sections

Neither Gould, Meadowcroft, nor Heckethorn teach, or suggest, the use of multiple consumable filler slug sections, let alone sections having retaining lips. Thus, the rejection of claim 18 is improper.

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D. Rejection of Claims 2, 5, 16, and 29 Under 35 U.S.C. § 103

The Office Action rejects claims 2, 5, 16, and 19 under 35 U.S.C. § 103(a) as being unpatentable over either Gould et al. (US 6,545,244) or Meadowcroft (US 1,568,080) in view of Heckethorn (US 3,081,587), and in further view of Sofue. Applicant respectfully traverses all
5 rejections.

I. The Office Action Fails to Establish a Prima Facie Case of Obviousness

a) There is No Basis in the Art for the Combination of Gould or Meadowcroft with Heckethorn and Sofue

There must be a basis in the art for the combination or modification of the prior art.

10 Here, the present invention directed to a resistance welding method in which the transfer of electrical current through a substrate, having a defect, heats the substrate and a consumable filler slug resulting in the coalescence of the consumable filler slug and a portion of the substrate in a substantially liquid weld pool.

Conversely, Gould and Meadowcroft are directed to conductive forms of welding. In other
15 words, they are directed to welding methods in which elements separate from the parts to be joined are heated to a temperature above the melting point of the workpieces such that the heat is transferred to the workpieces by conduction resulting the formation of a weld nugget and joining of the workpieces. Further, the separate elements, or cover sheets, of Gould and Meadowcroft that supply the heat for conduction into the workpieces, do not coalesce into the weld pool. In
20 fact, coalescence of the cover sheets of Gould and Meadowcroft would most likely render the operation inoperable because the coversheets must have a significantly greater electrical resistance than the workpieces, which generally means that the material properties of the cover

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sheets are not beneficial, and are often detrimental, to the formation of a quality weld in workpieces having relatively high electrical conductivity.

Alternatively, Heckethorn and Sofue are directed to an entirely different type of welding, expressed well in Gould at Col. 5, line 1; "... it is important to realize that this process is significantly different from standard resistance welding. With the conductive heat resistance seam welding process of the present invention, formation of the joint is similar to a continuous casting." In Heckethorn, the passage of electrical current through the plug results in resistive heating of the plug and the resulting closure of the cylinder. In Sofue, a material for increasing electrical resistance is placed between the plates to be joined, which are then joined by resistive spot welding. The conductive methods of Gould and Meadowcroft were developed in large part because traditional resistance welding simply does not work with many thin plate electrically conductive materials.

Therefore, there is no basis in the art for the combination of Gould or Meadowcroft in view of Heckethorn and Sofue, and thus the Office Action, has failed to establish a prima facie case of obviousness.

b) Gould or Meadowcroft are Not Properly Combinable with Heckethorn and Sofue as Their Intended Function is Destroyed

The combination or modification of the prior art is improper if the intended function is destroyed.

In order to achieve the resistance welding of Heckethorn, the plug must have an electrical resistance high enough to facilitate adequate generation of heat to support the melting and joining of the plug and the cylinder. Now, incorporate such an electrically resistive plug in a

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defect in the workpieces of Gould or Meadowcroft and then cover the plug and workpieces with the conduction cover sheets. Ignoring for a moment that it does not make any sense to attempt to repair a defect in an electrically conductive workpiece of Gould or Meadowcroft with an electrically resistive plug that works with traditional resistance welding (primarily due to material property issues), the heat from the cover sheets will follow the path of least resistance. This, combined with the fact that the cover sheets must have a higher melting temperature than the workpieces, but are unlikely to have a melting temperature higher than a traditional resistance welding plug, indicates that the intended functions of the methods of Gould and Meadowcroft would be not be effective in repairing a defect in the workpieces of Gould or Meadowcroft with the filler plug of Heckethorn. Applying the conductive welding principles of Gould or Meadowcroft to the application of Heckethorn would destroy the function of the Heckethorn method as the conductive heat welding methods of Gould and Meadowcroft are highly unlikely to work with set-up of Heckethorn.

Likewise, incorporation of the resistance increaser of Sofue into either Gould or Meadowcroft would destroy the intended functions of Gould and Meadowcroft. The conductive techniques of Gould and Meadowcroft are dependent upon good conduction paths between the workpieces, not a configuration like in Sofue with a clearance (air space) between the workpieces.

Therefore, since the references are not properly combinable or modifiable because their intended function is destroyed, the combination of Gould or Meadowcroft in view of Heckethorn and Sofue, and thus the Office Action, has failed to establish a prima facie case of obviousness.

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c) The Combination of Gould or Meadowcroft with Heckethorn and Sofue does Not Have a Reasonable Expectation of Success

The combination or modification of the prior art is improper if there is not a reasonable expectation of success. The conductive heat welding methods of Gould or Meadowcroft do not provide a reasonable expectation of success when combined with the resistance welding filler plug of Heckethorn or the resistance increasing spacer of Sofue. In fact, one skilled in the art would believe that using a resistance welding filler plug, or resistance increasing spacer, to repair a defect in electrically conductive materials, such as those disclosed in Gould and Meadowcroft, by using conductive heat welding techniques, does not have a reasonable expectation of success, but more likely a reasonable expectation of failure.

Therefore, since the combination of references does not have a reasonable expectation of success, the combination of Gould or Meadowcroft in view of Heckethorn and Sofue, and thus the Office Action, has failed to establish a prima facie case of obviousness.

d) The Combination of Gould or Meadowcroft with Heckethorn and Sofue Cannot be Used to Establish Obviousness Because They are Non-analogous

The combination of the prior art is improper if the prior art is non-analogous. Specifically, a reference must be in the same field as the invention, or the reference must be reasonably pertinent to a particular problem addressed by the invention. Gould and Meadowcroft are directed to conductive heat welding methods, which is not the same field as modified resistance welding repair methodology of the present invention. Further, Gould, Meadowcroft, Heckethorn, and Sofue are not reasonably pertinent to the problem addressed by the present invention,

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namely the repair of defects, as none of the references teach or suggest application to the repair of defects.

Therefore, since the references are not analogous to the present invention, the combination of Gould or Meadowcroft in view of Heckethorn and Sofue cannot be used to establish

5 obviousness, and thus the Office Action has failed to establish a prima facie case of obviousness.

e) The Office Action Does Not Consider All Claim Limitations in Determining

Obviousness

The Office Action must consider all claim limitations in establishing an obviousness rejection. Here, the Office Action appears to ignore (A) the location of the sacrificial retainer(s),
10 and (B) the fact that the retainer seals the pool from the surrounding environment, as specified in claims 2, 5, 16, and 19. Locating the resistance increasers, element 4, of Sofue in the claimed location of the present invention would render the Sofue method nonfunctional.

Therefore, since the Office Action does not consider all the claim limitations, the combination of Gould or Meadowcroft in view of Heckethorn and Sofue cannot be used to
15 establish obviousness, and thus the Office Action has failed to establish a prima facie case of obviousness.

II. A Zinc Plating Layer is Not a Sacrificial Retainer

The Office Action overreaches in its attempt to characterize the zinc plating layer of a
20 galvanized piece of sheet steel as a sacrificial retainer. The disclosure at Col. 5, lines 38-45 states:

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5 "The zinc plating layers 2 are melted first at the position on the mating surfaces with the highest temperature where a weld nugget is to be formed, and the melted zinc plating layers 2 are vaporized and expanded. Then they are excluded to the outside, and the base metals 3. are melted thinly over the mating surfaces."

Further, the disclosure at Col. 8, lines 52-54 of Sofue states:

10 "When a voltage is applied to the electrodes, first the zinc plating layers constituting the mating surfaces are heated and vaporized. The vaporized zinc flows through the tiny spaces formed around the spacer."

Thus, the zinc layers do not "retain" the liquid zinc. In fact, the zinc layers are most commonly vaporized and expelled from the area of the weld. Further, the zinc layers do not seal the pool from the surrounding environment, in fact the resistance increasers form a void between the workpieces that encourages the surrounding environment to get closer to the weld area than would typically be the case.

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E. Acknowledgment of Allowable Subject Matter

Applicant acknowledges and appreciates Office Action's indication that claim 21 would be allowable if rewritten or amended to overcome the 35 U.S.C. § 112 rejection. Applicant currently amends claim 21 to overcome the rejection.

Applicant acknowledges and appreciates Office Action's indication that claims 4 and 18 would be allowable if rewritten to overcome the 35 U.S.C. § 112 rejection and to include all of the limitations of the base claim and any intervening claims. Applicant currently amends the base claims and believes the base claims to be allowable in light of the remarks and amendments.

Conclusion

In view of the above, it is submitted that the claims are in condition for allowance. Allowance of Claims 1-21 at an early date and issuance is solicited. If any question should arise with respect to the above remarks, or if it would in any way expedite the prosecution of this case, applicant's attorney would appreciate a telephone call at (614) 228-6280 extension 18.

3/8/2006

Date

Respectfully submitted,




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CERTIFICATE OF FAX TRANSMISSION UNDER 37 CFR 1.8

5 I, undersigned, have transmitted the accompanying response by FAX to 571-273-8300 on
March 8, 2006 at 2:12 pm to the United States Patent and Trademark Office.


David J. Dawsey

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